

REMARKS

Claims 1-8 are pending and stand ready for further action on the merits. Claims 1-5 and 7 have been amended for clarity. Claim 9 is cancelled.

Claims 2-5 have been amended to recite that the n-type carrier and the p-type dopant are contained in a single layer. Support for this amendment is described below in "Sections 4-5."

Claim 4 has been amended to recite that layer (C) is adjacent to layer (A). Support for this amendment can be found in claim 3.

No new matter has been added by way of the above-amendment.

The following sections correspond to the sections of the March 24, 2003 Office Action.

Section 2

The Examiner objects to the specification for reciting that the semiconductor compound is a Group "3-5" compound and not Group "III-V" compound. In response, Applicants have amended the specification to recite that the semiconductor is a Group "III-V" compound.

Accordingly, withdrawal of the objection is respectfully requested.

Section 3

The Examiner objects to the claims for reciting that the semiconductor compound is a Group "3-5" compound and not Group "III-V" compound. In response, Applicants have amended the claims to recite that the semiconductor is a Group "III-V" compound.

Accordingly, withdrawal of the objection is respectfully requested.

Sections 4-5

Claim 9 is rejected under 35 U.S.C. §112, first paragraph. Applicants respectfully traverse the rejection.

Since claim 9 has been cancelled this rejection is rendered moot. However, in view of the fact that claims 1-5 have been amended to recite the subject matter of cancelled claim 9, the following comments are directed to the patentability of claims 1-5 with respect to the requirements of 35 USC 112, first paragraph.

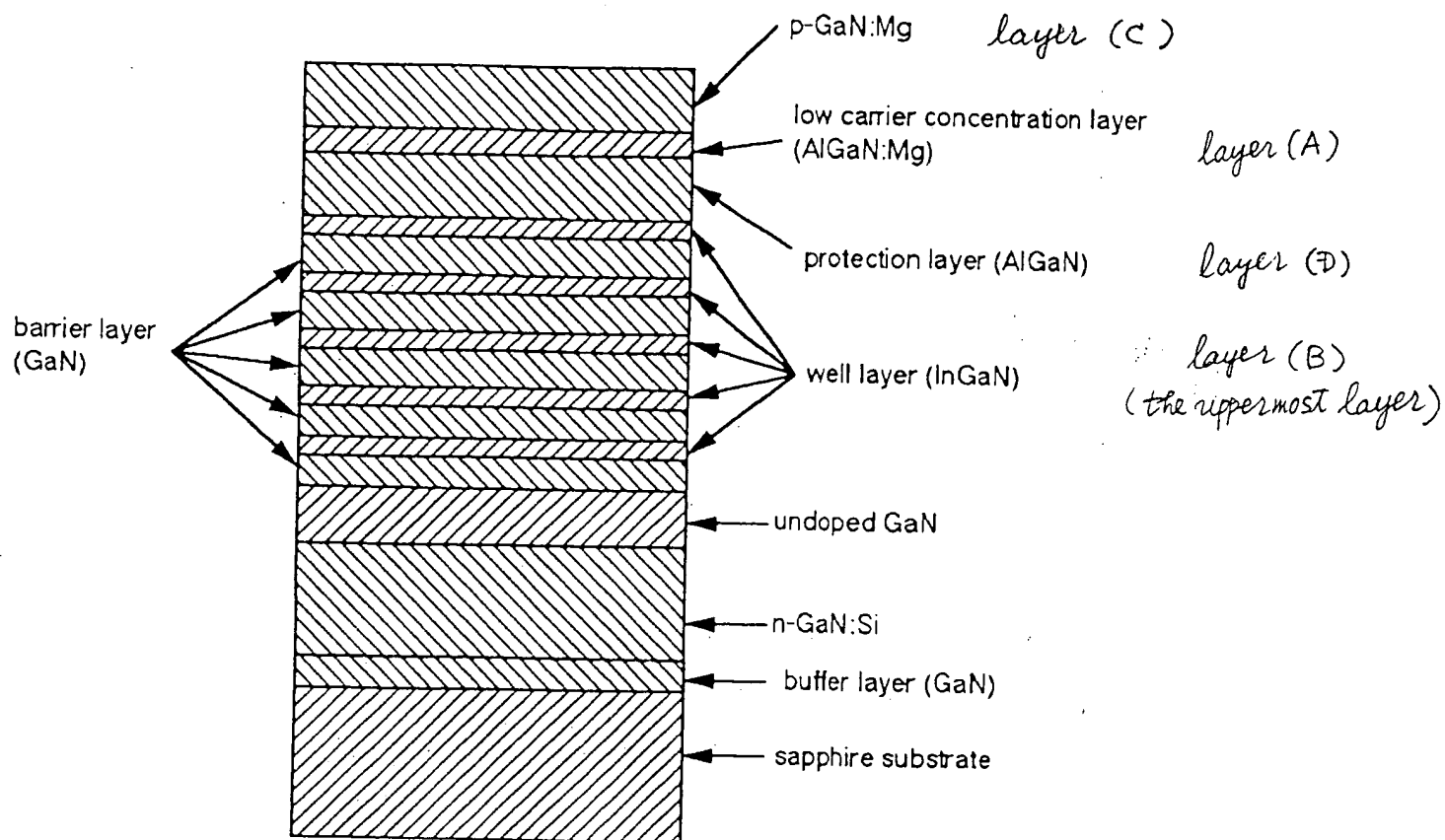
The Examiner has taken the position that the subject matter of claims 1-5 constitutes new matter. Specifically, the Examiner finds that the specification does not include adequate support for the inventive composition wherein the n-type carrier and the p-type dopant are contained in "a single layer."

Applicants respectfully submit that the skilled artisan would reasonably conclude that the specification does include adequate support for the inventive composition wherein the n-type carrier and the p-type dopant are contained in "a single layer."

The "single layer" of claims 1-5 is a single layer which does not include more than one layer.

The Examiner should be aware that in the first full paragraph on page 9 of the September 23, 2003 Amendment, Applicants mischaracterized the invention by indicating that two adjacent layers (of the semiconductor described in claims 2-4) can make up the "single layer". Applicants state for the record that two adjacent layers (of the semiconductor described in claims 2-4) **do not** make up the "single layer".

The following figure is the same figure which is a representation of Example 5 that was filed on June 13, 2003. This figure is marked to show an embodiment of the "single layer" of claims 1-5.



Illustrative figure showing the structure of the semiconductor produced in Example 5

As shown in the above figure, the layer of AlGaIn:Mg corresponds to the single layer in new claim 1. The layer also corresponds to layer (A) in claims 2-5.

Furthermore, it is clear from Examples 1-4 that the III-V group compound semiconductors of claim 1 represented by the general formula $\text{In}_x\text{Ga}_y\text{Al}_z\text{N}$ ($x+y+z=1$, $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$) and having both an n-type carrier and a p-type dopant, is in a single layer. In these Examples, a single layer is made and by CV measurement (capacitance-voltage measurement), it is clear that both the n-type carrier and the p-type dopant are present in the single layer.

Accordingly, the present inventors had possession of the invention as described in claims 1-5, as of the effective U.S. filing date. As such, the inventive claims satisfy the requirements of 35 U.S.C. §112, first paragraph.

Sections 6-7

Claims 1-8 are rejected under 35 U.S.C. §102(e) as being anticipated by Iyechika et al., U.S. 6,023,077. Applicants respectfully traverse the rejection.

Advantages of the Present Invention:

The inventive group III-V compound semiconductor of the general formula $\text{In}_x\text{Ga}_y\text{Al}_z\text{N}$ is formed with the concentration of the p-type dopant in a range of $1 \times 10^{17}\text{cm}^{-3}$ to $1 \times 10^{21}\text{cm}^{-3}$. By retaining the p-type impurity concentration within this range, it is relatively easy to control the n-type carrier concentration with high reproducibility and there is high crystallinity when the layer is laminated with a light-emitting layer. Thus, a light emitting device having high light emitting efficiency can be obtained.

Experimental evidence of this fact can be seen in the examples and comparative examples of the present specification.

Iyechika et al.:

Present claims 1-5 recite the following elements:

- (A) $\text{In}_x\text{Ga}_y\text{Al}_z\text{N}$ ($x+y+z=1$, $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$);
- (B) a concentration of an n-type carrier is $1 \times 10^{19}\text{cm}^{-3}$ or less; and
- (C) a concentration of a p-type dopant is $1 \times 10^{17}\text{cm}^{-3}$ to $1 \times 10^{21}\text{cm}^{-3}$.

The Examiner has maintained the rejection over Iyechika et al., and specifically cites the following passages of Iyechika et al.: column 2, lines 48-49 for teaching element (A); column 5,

lines 17-19 for teaching element (B); and column 7, lines 14-22 and column 8, lines 1-14 for teaching element (C).

With respect to element (B), the Examiner seems to be confusing the n-type dopant of Iyechika et al. with the inventive n-type carrier. These are distinct entities as shown in Inventive Examples 1-4 of the present specification. The Examiner will note that the semiconductors of Examples 1-4 are each single layer materials which were not prepared with added n-type dopant. However, Table 1 on page 16 of the specification describes these materials as having an n-type carrier concentration ranging from 2×10^{16} to $5 \times 10^{18} \text{ cm}^{-3}$. Thus, it is clear that the n-type dopant of Iyechika et al. and the inventive n-type carrier are distinct entities.

With regard to element (C), in column 8, lines 1-13, Iyechika teaches that the concentration range of the p-type dopant is not more than $1 \times 10^{19} \text{ cm}^{-3}$. The p-type dopant is doped in order to impart p-type conductivity to the layer. On the contrary, the layer of the present claim 1 has n-type conductivity even after being doped with p-type dopant.

With regard to both elements (B) and (C), as noted above, inventive claims 1-5 and the present specification teach that the concentration ranges of the n type carrier and the p-type dopant refer to the concentration ranges in a **single** layer of

the semiconductor. It is clear that the disclosure of Iyechika et al. cited by the Examiner refers to concentrations of dopants in separate layers. Accordingly, even if the inventive n type carrier is identical to the n type dopant of Iyechika et al. (which it is not), there is no teaching or suggestion by Iyechika et al. that the dopants have the inventive concentration in a single layer, as presently claimed.

As the MPEP instructs, all claim limitations must be taught in order that the cited reference anticipates the application claims. Since Iyechika et al. is silent with respect to having an n-type carrier in a concentration of $1 \times 10^{19} \text{ cm}^{-3}$ or less and a concentration of a p-type dopant having a concentration in the range of $1 \times 10^{17} \text{ cm}^{-3}$ to $1 \times 10^{21} \text{ cm}^{-3}$, in a single layer, Applicants respectfully submit that a *prima facie* case of anticipation based on Iyechika et al. does not exist.

Withdrawal of the anticipation rejection is respectfully requested.

Drawings

The present application has been amended to include one sheet of drawings, see the June 13, 2002 Preliminary Amendment. However, the Examiner has not indicated whether the drawings are

acceptable. The Examiner is requested to indicate whether the drawings are acceptable in the next communication.

Conclusion

In view of the above-amendments and comments, Applicants respectfully submit that the claims are in condition for allowance. A notice to such effect is earnestly solicited.

Pursuant to the provisions of 37 C.F.R. §§ 1.17 and 1.136(a), the Applicants hereby petition for an extension of one (1) month to December 23, 2003 in which to file a reply to the Office Action. The required fee of \$110.00 is enclosed herewith.

If the Examiner has any questions concerning this application, he is requested to contact Garth M. Dahlen, Ph.D., Esq., (#43,575) at the offices of Birch, Stewart, Kolasch & Birch, LLP.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees

Appln. No. 09/987,660

required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17;
particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By Raymond C. Stewart #43575
Raymond C. Stewart, #21,066 for

RCS/GMD/gh

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000